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09/831930
JC18 Rec'd PCT/PTO 15 MAY 2001

13.09.2000

Network connection

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The invention relates to a network connection comprising at least two wires for electrically connecting network users in a network.

Known network connections are constructed in such a way that they are suitable for data transmission through the two wires of the network connection. This has the drawback that both terminals of an energy power supply for the network users are to be realized via separate electric connections.

It is an object of the invention to provide a network connection which is suitable for both data transmission and energy transfer.

novelty?

According to the invention, this object is solved in that the network connection has a symmetrical structure and the two wires are twisted, in that the wires are mutually insulated to such an extent that they are suitable for a symmetrical, differential data transmission, and in that the two wires have the same electrical resistance and jointly have a cross-section which is suitable for energy transfer from a terminal of a voltage source to network users via both wires.

At novelty

In this network connection, data can be transmitted through the two wires. Moreover, the energy transfer can jointly take place through the two wires in that a terminal of a voltage source is coupled to the two wires so that energy transfer to the network users can take place through these wires.

For the energy transfer, the two wires jointly have such a cross-section that they are suitable for the currents flowing in response to the energy transfer.

The data transmission is advantageously realized symmetrically and differentially. To this end, the two wires are mutually insulated. This insulation should only be sufficient for the relatively low data transmission voltages. It should particularly not be suitable for relatively high voltages of a power supply for the network users, because only one pole of a voltage source is jointly coupled through the two wires.

Moreover, the two wires have the same electrical resistance in order that the symmetrical differential data transmission through the two wires has the same resistance. Moreover, the data transmission is thus not disturbed by the potential jumps which may occur as a result of the energy transfer.

The network connection has a symmetrical construction. This results in a high attenuation of disturbances of the power supply lines, which is achieved via a cancelling means ("Auslöschung").

To achieve a satisfactory decoupling with respect to external electric and magnetic fields, the two wires are advantageously twisted. This results in an improved mutual magnetic coupling of the two wires, which contributes to the signal-to-noise ratio of the data transmission.

Since the load current for the energy supply is jointly passed through the two wires of the network connection, it is not desirable to use additional copper for this purpose. The overall cross-section of the two wires must only be chosen to be as large as the cross-section of a wire of a separate cable connection for the energy transfer.

For the insulation between the two wires, a thin, inexpensive insulation is admissible because, on the one hand, only the low data transmission voltages are to be insulated and, on the other hand, only the communication rather than the energy supply drops out, even in the case of a failing insulation.

As described in an embodiment as defined in claim 2, only one of the wires may be provided with an insulation for this purpose.

~~Since the insulation can be formed in a relatively simple manner, a lacquer coating, a synthetic material coating or a tubing may be provided as insulations, as described in further embodiments of the invention.~~

When stranded wires are used, they can be advantageously insulated by means of a cladding of one of the stranded wires or by means of an insulation between the two stranded wires, as described in a further embodiment of the invention as defined in claim 6.

The network connection according to the invention may also be in a double form, as defined in claim 7. A pole for the energy supply is then coupled via one of the network connections. The data transmission may be realized in a redundant form through the two network connections so that the transmission reliability is enhanced.

To simplify a contact of the network connection, for example, to a network coupler, the outer insulation and the twisting of the wires may be advantageously formed as defined in claim 8.

The network connection according to the invention can be advantageously used in vehicles in which a pole for the power supply is coupled via the chassis of the vehicle. Then, both the data transmission and the power supply for the other pole can take

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place via the network connection according to the invention. An additional cable connection with two wires for the power supply can then be dispensed with.

These and other aspects of the invention are apparent from and will be elucidated with reference to the embodiments described hereinafter.

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~~In the drawings:~~

Fig. 1 shows a network comprising a plurality of network users, among which a network connection according to the invention is established,

Fig. 2 is a cross-section through a first embodiment of a network connection according to the invention, in which only one wire is insulated,

Fig. 3 is a cross-section through a second embodiment of a network connection according to the invention, in which both wires are provided with a thin lacquer coating, and

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~~Fig. 4 is a cross-section through a third embodiment of a network connection according to the invention, in which the wires are formed as stranded wires.~~

Fig. 1 shows a network connection according to the invention, with two wires 1 and 2. The network connection has a star-shaped configuration and interconnects a plurality of network users 3, 4, 5 and 6. A further network user 7 is provided which is coupled to a terminal of a voltage source U_B and couples this terminal into the two wires 1 and 2 of the network connection.

Via network couplers 8, the network users 3, 4, 5 and 6 are capable of coupling out the required energy symmetrically from the two wires 1 and 2 of the network connection. Furthermore, the network users 3, 4, 5 and 6 transmit data via the two wires 1 and 2 of the network connection according to the invention, which is coupled in and coupled out via the network couplers and is formed in such a way that the data are transmitted symmetrically and differentially through the two wires 1 and 2.

The other terminal of the voltage source U_B may be connected, for example, to the chassis of the vehicle comprising the network users 3 to 7.

The circuit diagram shown in Fig. 1 illustrates that an additional cable connection with two wires for the transfer of energy may be dispensed with in the network connection according to the invention. One terminal for the power supply is coupled via the

two wires 1 and 2 of the network connection according to the invention, and the other terminal is coupled via the chassis of the vehicle.

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~~Due to the specific construction of the two wires 1 and 2 of the network connection according to the invention, which will be further described hereinafter, these wires 1 and 2 are also simultaneously suitable for a symmetrical, differential data transmission.~~

This is particularly achieved in that the two wires 1 and 2 are symmetrical and the energy is transferred symmetrically through the two wires. Disturbances caused by the energy transfer thus do not affect the data transmission, because the differential, symmetrical transmission cancels the disturbances during the evaluation of the data transmission.

The two wires 1 and 2 are mutually twisted so as to achieve a satisfactory decoupling from external electric magnetic fields. Moreover, the magnetic coupling between the two wires is thereby improved.

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~~The mutual insulation of the two wires may be relatively simple and thin because this insulation should only insulate the relatively low data transmission voltages. Since a pole for the power supply is jointly coupled through the two wires, these relatively high currents or voltages do not require insulations between the wires.~~

Fig. 2 is a cross-section through a first embodiment 11 of a network connection according to the invention, with two wires 1 and 2. The two wires have the same cross-section and are electrically constructed in such a way that they have the same resistance.

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~~In the embodiment shown in Fig. 2, only one of the wires, namely the wire 1, is provided with a thin outer insulation 13. This insulation 13 may be, for example, an insulating tubing or a lacquer coating. This insulation 13 should only be formed in such a way that it is adequate for the opposite data transmission voltages occurring in the two wires 1 and 2, which voltages are, however, relatively small.~~

Furthermore, a joint outer insulation 16 is provided.

The two wires 1 and 2 are mutually twisted in a way which is not further shown in Fig. 2.

To make optically optimal connection points, for example, for network couplers or the like visible in the network connection, the outer insulation 16 may be advantageously formed in such a way that the position of the two wires 1 and 2 in the network connection is visible, i.e. the twisting is recognizable from the exterior. Moreover,

the twisting of the two wires may be advantageously interrupted so as to provide optimal connection points on the two wires 1 and 2.

The cross-section through the first embodiment of the network connection according to the invention, as shown in Fig. 2, illustrates that both a data transmission and a terminal for a voltage source can be established via a network connection which is actually built up in a relatively simple manner, in which even the mutual insulation of the wires may be relatively simple.

This is also shown by a second embodiment shown also in a cross-section in Fig. 3 of a network connection according to the invention which also comprises two wires 1 and 2. However, in the second embodiment shown in Fig. 3, both wires 1 and 2 are provided with a thin outer insulation 21 and 22, respectively. For example, a thin lacquer coating which can be provided in a relatively easy way is sufficient for this purpose. Basically, this insulation may also consist of a synthetic material coating. It is alternatively possible to slide, for example, thin tubings on one or both wires 1 and 2.

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~~The complete network connection is surrounded by an outer insulation 21.~~

Fig. 4 also shows, in a cross-section, an embodiment of a network connection according to the invention, in which the two wires 1 and 2 are constituted by stranded wires 32 and 33.

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~~In Fig. 4A, the stranded wires 32 and 33 are mutually separated and insulated by means of an insulation 34. The complete stranded wires 32 and 33 are embedded in an insulation 35 so that they cannot move with respect to each other, and the insulation 34 ensures a safe insulation of the two stranded wires 32 and 33 forming part of the two wires 1 and 2.~~

Fig. 4B is similar to Fig. 4A, showing wires 1 and 2 constituted by stranded wires 32 and 33. However, in this case, not only an insulation 34 as in Fig. 4A is provided but also a cladding for one of the stranded wires. In the embodiment shown in Fig. 4B, the stranded wires 33 of the second wire 2 are completely insulated from the exterior by this cladding 36. Here again, the two stranded wires 32 and 33 are embedded in an outer insulation 35.

All embodiments shown in the Figures show that the network connection according to the invention may have a relatively simple structure because only a simple insulation between the wires 1 and 2 is required. Nevertheless, it is suitable for data transmission as well as for energy transfer.